federal register

WEDNESDAY, OCTOBER 4, 1972
WASHINGTON, D.C.

Volume 37 ■ Number 193

PART II

ENVIRONMENTAL PROTECTION AGENCY

■

CONTROL OF AIR POLLUTION FROM LIGHT DUTY DIESEL MOTOR VEHICLES

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Notice of Proposed Rule Making

ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 85]

CONTROL OF AIR POLLUTION FROM NEW MOTOR VEHICLES AND NEW MOTOR VEHICLE ENGINES

Standards and Test Procedures for Light Duty Diesel Motor Vehicles

Emission control standards for light duty vehicles have to date been imposed by the Federal Government only on gasoline-fueled vehicles. The Environmental Protection Agency now proposes to amend the regulations in 40 CFR Part 85 to:

(a) Extend the applicability of exhaust emission standards to new diesel-fueled light duty vehicles, beginning with the 1975 model year; and

(b) Extend the applicability of the analytical procedures and instrumentation for the measurement of carbon monoxide and oxides of nitrogen to new diesel-fueled light duty vehicles; and

(c) Prescribe special analytical procedures and instrumentation for the measurement of hydrocarbon emissions from new diesel-fueled light duty vehicles.

The section number system contained in this proposed subpart is designed to coordinate with a renumbering of the motor vehicle regulations which is now in process. All cross-references to sections in existing subparts conform to the numbering system presently in effect.

40 CFR Part 85 as so amended would become effective 30 days after republication and would be applicable to 1975 and subsequent model year diesel-fueled light duty vehicles.

The Agency has determined that gaseous-fueled light duty vehicles are likely to be offered for sale by model year 1975. The analytical procedure currently prescribed for gasoline-fueled vehicles is appropriate for the testing of gaseous-fueled vehicles. The Agency will soon propose amendments to make existing standards and test procedures for gasoline-fueled light duty vehicles to apply to gaseous-fueled vehicles as well. Those procedures will include fuel specifications for gaseous-fueled vehicles.

Interested persons may submit written data, views, or arguments (in quadruplicate) in regard to the proposed regulations to the Administrator, Environmental Protection Agency, Attention: Office of Air Programs, 4th and M Streets SW., Washington, DC 20460. All relevant material received not later than 60 days after publication of this notice will be considered. The Environmental Protection Agency is particularly interested in receiving data pertinent to the hydrocarbon sampling system and in particular related to the locations of the hydrocarbon sampling point in the system. Comments submitted shall be available for public inspection during normal business hours at the Office of Public Affairs, Environmental Protection Agency, 4th and M Streets SW., Washington, DC 20460.

This notice of proposed rule making is issued under the authority of section 202 of the Clean Air Act (42 U.S.C. 1857f–1).

Dated: September 22, 1972.

WILLIAM D. RUCKELSHAUS,
Administrator.

Subpart L—Standards and Test Procedures for Vehicle Exhaust Emissions (Diesel-Fueled Light Duty Vehicles)

Sec.

85.175–1 Applicability (1975 model year).
85.175–2 Standards for exhaust emissions.
85.175–3 Test procedures.
85.175–4 Diesel fuel specifications.
85.175–5 Vehicle preconditioning.
85.175–6 Dynamometer driving schedule.
85.175–7 Dynamometer procedure.
85.175–8 Three-speed manual transmissions.
85.175–9 Four-speed and five-speed manual transmissions.
85.175–10 Automatic transmissions.
85.175–11 Engine starting and re-starting.
85.175–12 Sampling and analytical system (exhaust emissions).
85.175–13 Information to be recorded.
85.175–14 Analytical system calibration and sample handling.
85.175–15 Dynamometer test runs.
85.175–16 Chart reading.
85.175–17 Calculations (exhaust emissions).
85.175–18 Test vehicles.
85.175–19 Maintenance.
85.175–20 Mileage accumulations and emission measurements.
85.175–21 Compliance with emission standards.
85.176–1 Applicability (1976 model year).
85.176–2 Standards for exhaust emissions.

AUTHORITY: The provisions of this Subpart L issued under section 202 of the Clean Air Act (42 U.S.C. 1857f–1).

Subpart L—Standards and Test Procedures for Vehicle Exhaust Emissions (Diesel-Fueled Light Duty Vehicles)

§ 85.175–1 Applicability (1975 model year).

The provisions of this subpart are applicable to new diesel fueled light duty motor vehicles beginning with the model year specified therein.

§ 85.175–2 Standards for exhaust emissions.

(a) Exhaust emissions from 1975 model year vehicles shall not exceed:

(1) Hydrocarbons—0.41 grams per vehicle mile.

(2) Carbon monoxide—3.4 grams per vehicle mile.

(3) Oxides of nitrogen—3.1 grams per vehicle mile.

(b) The standards set forth in paragraph (a) of this section refer to the exhaust emitted over a driving schedule as set forth in the following sections of this subpart and measured and calculated in accordance with these sections.

(c) Every manufacturer of new motor vehicles subject to the standards prescribed in this section shall, prior to taking any of the actions specified in section 203(a)(1) of the Act, test or cause to be tested motor vehicles in accordance with the following test procedures to ascertain that such test vehicles meet the requirements of this section as applicable.

§ 85.175–3 Test procedures.

The procedures described in this subpart will be the test program to determine the conformity of diesel fueled light duty vehicles with the applicable standards set forth in this subpart.

(a) The test consists of prescribed sequences of fueling, parking, and operating conditions. The exhaust gases generated during vehicle operation are diluted with air and sampled continuously for analysis of diesel exhaust hydrocarbons and subsequent analysis of other specific components by prescribed techniques. This test applies to vehicles equipped with catalytic or direct flame afterburners, other control systems or to uncontrolled vehicles and engines. All test phases are conducted with an ambient temperature range between 68° and 86° F.

(b) The exhaust emission test is designed to determine hydrocarbon, carbon monoxide, and oxides of nitrogen mass emissions while simulating an average trip in an urban area of 7.5 miles. The test consists of engine startups and vehicle operation on a chassis dynamometer through a specified driving schedule, as described in Appendix A to this part. Using a constant volume (variable dilution) sampler, a proportional part of the diluted exhaust gas is analyzed continuously for hydrocarbons and an additional proportional part of the diluted exhaust gas is collected in a bag for subsequent analysis of the other components.

§ 85.175–4 Diesel fuel specifications.

(a) The diesel fuels employed for testing shall be clean and bright, with pour and cloud points adequate for operability. The fuels may contain nonmetallic additives as follows: Cetane improver, metal deactivator, antioxidant, dehazer, antirust, pour depressant, dye, and dispersant.

(b) Fuel meeting the following specifications, or substantially equivalent specifications approved by the Administrator, shall be used in exhaust emissions testing. The grade of fuel recommended by the engine manufacturer, commercially designated as "Type 1–D" or "Type 2–D", shall be used.

Item	ASTM test method No.	Type 1-D	Type 2-D
Cetane	D 613	48-54	42-50
Distillation range	D 86		
IBP, °F		330-390	340-400
10-percent point, °F		370-430	400-460
50-percent point, °F		410-480	470-540
90-percent point, °F		460-520	550-610
EP, °F		500-560	580-660
Gravity, ° API	D 287	40-44	33-37
Total Sulfur, percent	D 129 or D 2622	0.05-0.30	0.2-0.5
Hydrocarbon composition	D 1319		
Aromatics, percent		8-15	27 (Min.)
Paraffins, Naphthenes, Olefins		Remainder.	Remainder.
Flashpoint, °F. (minutes)	D 93	120	130
Viscosity, Centistokes	D 445	1.6-2.0	2.0-3.2

(c) Fuel meeting the following specifications, or substantially equivalent specifications approved by the Administrator, shall be used in service accumulation. The grade of fuel recommended by the engine manufacturer, commercially designated as "Type 1-D" or "Type 2-D", shall be used.

Item	ASTM test method No.	Type 1-D	Type 2-D
Cetane	D 613	48-54	42-55
Distillation range	D 86		
IBP, ° F		330-390	340-410
10-percent point, ° F		370-430	400-470
50-percent point, ° F		410-480	470-540
90-percent point, ° F		460-520	550-610
EP, ° F		500-560	580-660
Gravity, ° API	D 287	40-44	33-40
Total Sulfur, percent	D 129 or D 2622	0.05-0.20	0.2-0.5
Flash point, ° F. (minute)	D 93	120	130
Viscosity, Centistokes	D 445	1.6-2.0	2.0-3.2

(d) Other Petroleum Distillation Fuel Specifications:

(i) Other petroleum distillate fuels may be used for testing and service accumulation provided they are commercially available, and

(ii) Information, acceptable to the Administrator, is provided to show that only the designated fuel would be used in customer service, and

(iii) Use of a fuel listed under paragraphs (b) and (c) of this section would have a detrimental effect on emissions or durability, and

(iv) Written approval from the Administrator of the fuel specifications was provided prior to the start of testing.

(e) The specification range of the fuels to be used under paragraphs (b), (c), and (d) of this section shall be reported in accordance with § 85.51.

§ 85.175-5 Vehicle preconditioning.

Vehicles to be tested for compliance with the exhaust emission standards of this part shall be preconditioned as follows:

(a) The fuel tank shall be drained and specified test fuel added.

(b) The test vehicle shall be placed on the dynamometer and operated over a simulated trip, according to the applicable requirements and procedures of §§ 85.175-6 to 85.175-11 except that the engine need not be cold when starting the run on the dynamometer and only a single trip of 7.5 miles shall be run, or the vehicle may be driven on a road route covering a distance of 7 to 8 miles and a total elapsed time of 20 to 25 minutes.

(c) The engine and cooling fan shall be stopped upon completion of the dynamometer operation and the vehicle permitted to soak either on or off the dynamometer stand for a period of not less than 12 hours prior to the dynamometer test.

§ 85.175-6 Dynamometer driving schedule.

(a) The dynamometer driving schedule to be followed consists of a nonrepetitive series of idle, acceleration, cruise, and deceleration modes of various time sequences and rates. The driving schedule is defined by a smooth transition through the speed vs. time relationships listed in Appendix A to this part. The time sequence begins upon starting the vehicle according to the startup procedure described in § 85.175-11.

(b) The speed tolerance at any given time on the dynamometer driving schedule prescribed in Appendix A to this part or as printed on a driver's aid chart approved by the Administrator is defined by upper and lower limits. The upper limit is 2 m.p.h. higher than the highest point on the trace within 1 second of the given time. The lower limit is 2 m.p.h. lower than the lowest point on the trace within 1 second of the given time. Speed variations greater than the tolerances (such as occur when shifting manual transmission vehicles) are acceptable provided they occur for less than 2 seconds on any one occasion. Speeds lower than those prescribed are acceptable provided the vehicle is operated at maximum available power during such occurances. Further, speed deviations from those prescribed due to stalling are acceptable provided the provisions of § 85.175-11(d) are adhered to.

§ 85.175-7 Dynamometer procedure.

(a) The dynamometer run consists of two tests, a "cold" start test after a minimum 12 hour soak and a "hot" start test with a 10 minute soak between the two tests. Engine startup, operation over the driving schedule, and engine shutdown make a complete cold start test. Engine startup and operation over the first 505 seconds of the driving schedule complete the hot start test. The exhaust emissions are diluted with air to a constant volume and a portion is sampled continuously during each test. Diesel hydrocarbons are analyzed continuously, with electronic integration, during each test. The composite (flow integrated) samples collected in bags are analyzed for carbon monoxide, carbon dioxide, and oxides of nitrogen. A parallel sample of dilution air is analyzed for hydrocarbon, carbon monoxide and oxides of nitrogen.

(b) During dynamometer operation, a fixed speed cooling fan shall be positioned so as to direct cooling air to the vehicle in an appropriate manner with the engine compartment cover open. The fan capacity shall normally not exceed 5,300 c.f.m. If, however, the manufacturer can show that during field operation the vehicle received additional cooling, the fan capacity may be increased or additional fans used if approved in advance by the Administrator. In the case of vehicles with front engine compartments, the fan(s) shall be squarely positioned between 8 and 12 inches in front of the cooling air inlets (grill). In the case of vehicles with rear engine compartments (or if special designs make the above impractical), the cooling fan(s) shall be placed in a position to provide sufficient air to maintain engine cooling.

(c) The vehicle shall be nearly level when tested in order to prevent abnormal fuel distribution.

(d) Flywheels, electrical or other means of simulating inertia shall be used. If the equivalent inertia specified in the following table is not available on the dynamometer being used, the next higher equivalent inertia (not to exceed 250 lbs.) available shall be used.

Loaded vehicle weight, pounds	Equivalent inertia weight, pounds	Road load power at 50 m.p.h. horsepower
Up to 1,125	1,000	5.9
1,126 to 1,375	1,000	6.5
1,376 to 1,625	1,500	7.1
1,626 to 1,875	1,750	7.7
1,876 to 2,125	2,000	8.3
2,126 to 2,375	2,250	8.8
2,376 to 2,625	2,500	9.4
2,626 to 2,875	2,750	9.9
2,876 to 3,250	3,000	10.3
3,251 to 3,750	3,500	11.2
3,751 to 4,250	4,000	12.0
4,251 to 4,750	4,500	12.7
4,751 to 5,250	5,000	13.4
5,251 to 5,750	5,500	13.9
5,751 to above	5,500	14.4

(e) Power absorption unit adjustment:

(1) The power absorption unit shall be adjusted to reproduce road load power at 50 m.p.h. true speed. The indicated road load power setting shall take into account the dynamometer friction. The relationship between road load (absorbed) power and indicated road load power for a particular dynamometer shall be determined by the procedure outlined in Appendix B to this part or other suitable means.

(2) The road load power listed in the table above shall be used or the vehicle manufacturer may determine the road load power by the following procedure and request its use:

(i) Measuring the fuel flow rate of a representative vehicle of the same equivalent inertia weight class, when operated on a level road under balanced wind conditions at a true speed of 50 m.p.h., and

(ii) Noting the dynamometer indicated road load horsepower setting required to reproduce that fuel flow rate when the same vehicle is operated on the dynamometer at a true speed of 50 m.p.h. The tests on the road and on the dynamometer shall be performed with the same vehicle ambient absolute pressure (usually barometric), i.e. within ±5 mm. Hg.

(iii) The road load power shall be determined according to the procedure outlined in Appendix B to this part and adjusted according to the following if applicable.

(3) Where it is expected that more than 33 percent of the vehicles in an engine family will be equipped with air-conditioning, the road load power listed above or as determined in subparagraph (2) of this paragraph shall be increased by 10 percent for testing all test vehicles representing such engine family.

(f) The vehicle speed (m.p.h.) as measured from the dynamometer rolls shall be used for all conditions. A speed vs. time recording, as evidence of dynamometer test validity, shall be supplied on request of the Administrator.

(g) Practice runs over the prescribed driving schedule may be performed to find the minimum accelerator pedal action to maintain the proper speed-time relationship.

NOTE: When using two-roll dynamometers a truer speed-time trace may be obtained by minimizing the rocking of the vehicle in the rolls. The rocking of the vehicle changes the tire rolling radius on each roll. The rocking may be minimized by restraining the vehicle horizontally (or nearly so) by using a cable and winch.

(h) The drive wheel tires may be inflated up to 45 p.s.i.g. in order to prevent tire damage. The drive wheel tire pressure shall be reported with the test results.

(i) If the dynamometer has not been operated during the 2-hour period immediately preceding the test it shall be warmed up for 15 minutes by operating it at 30 m.p.h. using a nontest vehicle.

§ 85.175–8 Three-speed manual transmissions.

(a) All test conditions except as noted shall be run in highest gear.

(b) Cars equipped with free wheeling or overdrive units shall be tested with this unit (free wheeling or overdrive) locked out of operation.

(c) Idle shall be run with transmission in gear and with clutch disengaged (except first idle; see § 85.175–11).

(d) The vehicle shall be driven with minimum accelerator pedal movement to maintain the desired speed.

(e) Acceleration modes shall be driven smoothly with the shift speeds as recommended by the manufacturer. If the manufacturer does not recommend shift speeds, the vehicle shall be shifted from first to second gear at 15 m.p.h. and from second to third gear at 25 m.p.h. The operator shall release the accelerator pedal during the shift, and accomplish the shift with minimum time. If the vehicle cannot accelerate at the specified rates, the vehicle shall be accelerated at maximum available power until the vehicle speed reaches the speed at which it should be at that time during the test.

(f) The deceleration modes shall be run with clutch engaged and without shifting gears from the previous mode, using brakes or accelerator pedal as necessary to maintain the desired speed. For those modes which decelerate to zero, the clutch shall be depressed when the speed drops below 15 m.p.h. when engine roughness is evident, or when engine stalling is imminent.

(g) Downshifting is allowed at the beginning of or during a power mode if recommended by the manufacturer or if the engine obviously is lugging.

§ 85.175–9 Four-speed and five-speed manual transmissions.

(a) Use the same procedure as for three-speed manual transmissions for shifting from first to second gear and from second to third gear. If the manufacturer does not recommend shift speeds, the vehicle shall be shifted from third to fourth gear at 40 m.p.h. Fifth gear may be used at the manufacturer's option.

(b) If transmission ratio in first gear exceeds 5:1, follow the procedure for three- or four-speed manual transmission vehicles as if the first gear did not exist.

§ 85.175–10 Automatic transmissions.

(a) All test conditions shall be run with the transmission in "Drive" (highest gear). Automatic stick-shift transmissions may be shifted as manual transmissions at the option of the manufacturer.

(b) Idle modes shall be run with the transmission in "Drive" and the wheels braked (except first idle; see § 85.175–11).

(c) The vehicle shall be driven with minimum accelerator pedal movement to maintain the desired speed.

(d) Acceleration modes shall be driven smoothly allowing the transmission to shift automatically through the normal sequence of gears. If the vehicle cannot accelerate at the specified rates, the vehicle shall be accelerated at maximum available power until the vehicle speed reaches the speed at which it should be at that time during the driving schedule.

(e) The deceleration modes shall be run in gear using brakes or accelerator pedal as necessary to maintain the desired speed.

§ 85.175–11 Engine starting and restarting.

(a) The engine shall be started according to the manufacturer's recommended starting procedures. The initial 20-second-idle period shall begin when the engine starts. The transmission shall be placed in gear 15 seconds after the engine is started. If necessary, braking may be employed to keep the drive wheels from turning.

(b) If the vehicle does not start after 10 seconds of cranking, cranking shall cease and the reason for failure to start shall be determined. The revolution counter on the constant volume sampler and the hydrocarbon integrator (see § 85.175–15 *Dynamometer test runs*) shall be turned off and the sample solenoid valves placed in the "dump" position during this diagnostic period. In addition, either the positive displacement pump should be turned off or the exhaust tube disconnected from the tailpipe during the diagnostic period. If failure to start is an operational error, the vehicle shall be rescheduled for testing from a cold start. If failure to start is caused by vehicle malfunction, corrective action of less than 30 minutes duration may be taken and the test continued. The sampling system shall be reactivated at the same time cranking is started. When the engine starts, the driving schedule timing sequence shall begin. If failure to start is caused by vehicle malfunction and the vehicle cannot be started, the test shall be voided, the vehicle removed from the dynamometer, corrective action taken, and the vehicle rescheduled for test. The reason for the malfunction (if determined) and the corrective action taken shall be reported.

(c) If the engine "false starts", the operator shall repeat the recommended starting procedure.

(d) Stalling:

(1) If the engine stalls during an idle period, the engine shall be restarted immediately and the test continued. If the engine cannot be started soon enough to allow the vehicle to follow the next acceleration as prescribed, the driving schedule indicator shall be stopped. When the vehicle restarts the driving schedule indicator shall be reactivated.

(2) If the engine stalls during some operating mode other than idle, the driving schedule indicator shall be stopped, the vehicle restarted, accelerated to the speed required at that point in the driving schedule and the test continued.

(3) If the vehicle will not restart within 1 minute, the test shall be voided, the vehicle removed from the dynamometer, corrective action taken, and the vehicle rescheduled for test. The reason for the malfunction (if determined) and the corrective action taken shall be reported.

§ 85.175–12 Sampling and analytical system (exhaust emissions).

(a) *Schematic drawings.* The following figures (Fig. L 175–1, L 175–2 and L 175–3) are schematic drawings of the exhaust gas sampling and analytical systems which will be used for testing under the regulations in this part. Additional components such as instruments, valves, solenoids, pumps, and switches may be used to provide additional information and coordinate the functions of the component systems.

(b) *Component description (exhaust gas sampling system).* The following components will be used in the exhaust gas sampling system for testing under the regulations in this part. See Figure L 175–1. Other types of constant volume

samplers may be used if shown to yield equivalent results.

(1) A dilution air filter assembly consisting of a particulate (paper) filter to remove solid matter from the dilution air and thus increase the life of the charcoal filter; a charcoal filter to reduce and stabilize the background hydrocarbon level; and a second particulate filter to remove charcoal particles from the air stream. The filters shall be of sufficient capacity and the duct which carries the dilution air to the point where the exhaust gas is added shall be of sufficient size so that the pressure at the mixing point is less than 1 inch of water pressure below ambient when the constant volume sampler is operating at its maximum flow rate.

(2) A flexible, leak-tight connector and tube to the vehicle tailpipe. The flexible tubing shall be sized and connected in such a manner that the static pressure variations in the vehicle tailpipe(s) remain within ±3 inches of water of the static pressure variations measured during a dynamometer driving cycle with no connection to the tailpipe(s).

(3) A heating system to preheat the heat exchanger to with ±10° F. of its operating temperature before the test begins.

(4) A heat exchanger capable of limiting the gas mixture temperature variation during the entire test to ±10° F. as measured at the sample point.

(5) A positive displacement pump to pump dilute exhaust mixture. The pump capacity (300 to 350 c.f.m. is sufficient for testing most vehicles) shall be large enough to virtually eliminate water condensation in the system. See Appendix C to this part for flow calibration techniques.

(6) Temperature sensor (T1) with an accuracy of ±2°F. to allow continuous recording of the temperature of the dilute exhaust mixture entering the positive displacement pump. (See § 85.175–13(k)).

(7) Gauge (G1) with an accuracy of ±2 percent of reading to measure the pressure depression of the dilute exhaust mixture entering the positive displacement pump, relative to atmospheric pressure.

(8) Gauge (G2) with an accuracy of ±2 percent of reading to measure the pressure increase across the positive displacement pump.

(9) Sample probes (S1, S2, and S3) pointed upstream to collect samples from the dilution air stream and the dilute exhaust mixture. Additional sample probes may be used, for example to obtain continuous concentration traces of the dilute exhaust stream. In such case the sample flow rate, in standard cubic feet per test phase, must be added to the calculated dilute exhaust volume. The position of the sample probes in Figure L 175–1 is pictorial only. The heated sample line (S3) between the sampling point and the analyzer shall be as short as possible.

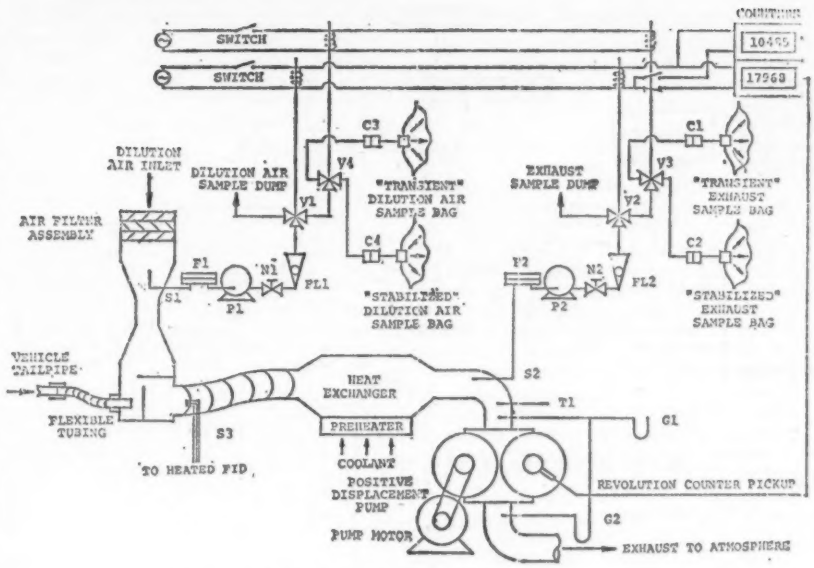

Figure L 175-1 Exhaust Gas Sampling System

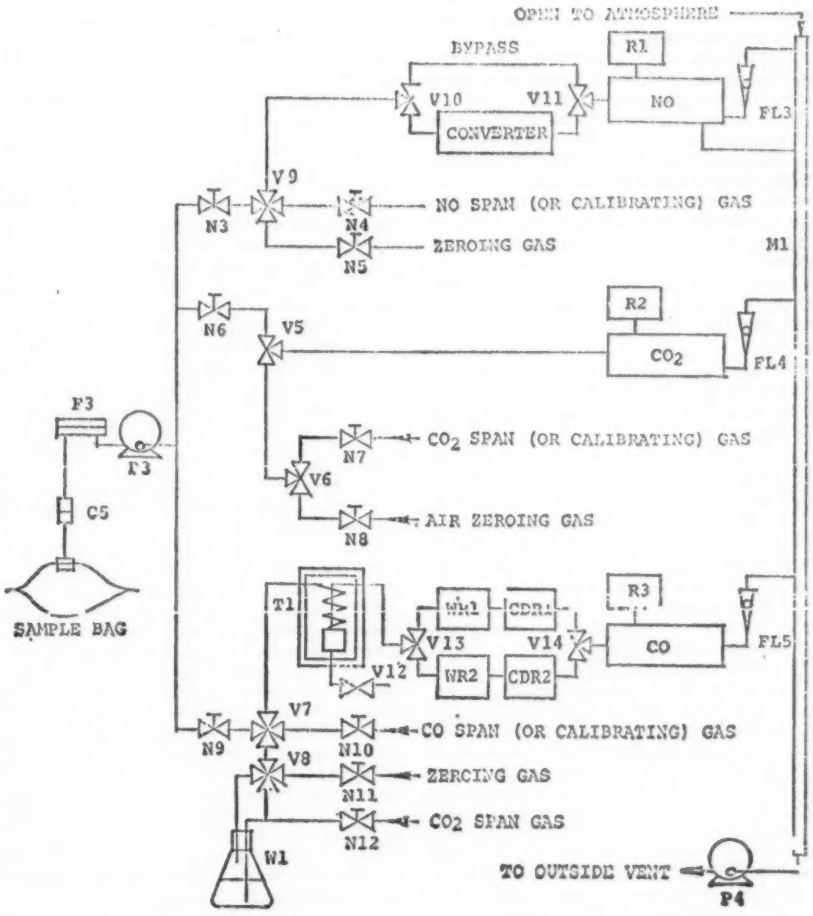

Figure L 175-2 Exhaust Gas Bench Analytical System

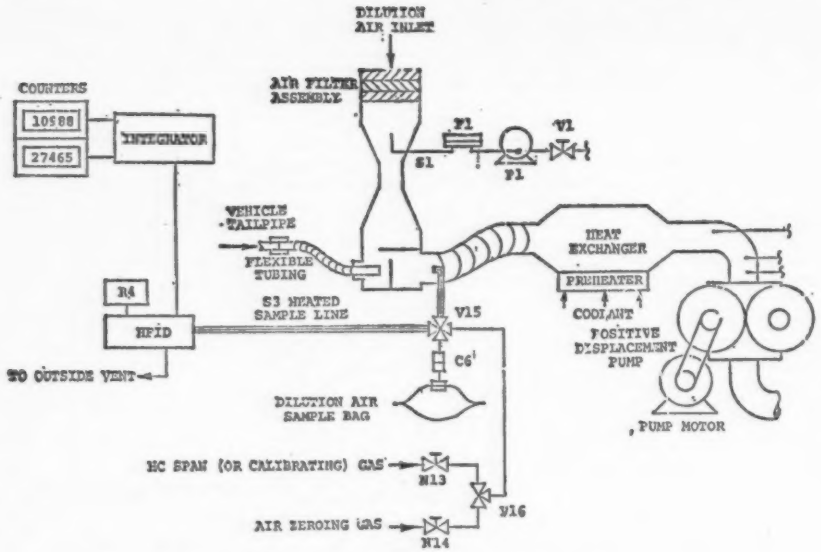

Figure L 175-3 Diesel Hydrocarbon Continuous Analysis System

(10) Filters (F1 and F2) to remove particulate matter from dilution air and dilute exhaust samples.

(11) Pumps (P1 and P2) to pump the dilution air and dilute exhaust into their respective sample collection bags.

(12) Flow control valves (N1 and N2) to regulate flows to sample collecton bags, at constant flow rates. The minimum sample flow rate shall be 10 c.f.h.

(13) Flowmeters (FL1 and FL2) to insure, by visual observation, that constant flow rates are maintained throughout the test.

(14) Three-way solenoid valves (V1, V2, V3, and V4) to direct sample streams to either their respective bags or overboard.

(15) Quick-connect, leak-tight fittings (C1, C2, C3, and C4) with automatic shut-off on bag side to attach sample bags to sample system.

(16) Sample collection bags for dilution air and exhaust samples of sufficient capacity so as not to impede sample flow.

(17) Revolution counters to count the revolutions of the positive displacement pump while each test phase is in progress and samples are being collected.

(c) *Component description (exhaust gas batch analytical system).* The following components will be used in the exhaust gas batch analytical system for testing under the regulations in this part. The analytical system provides for the determination of carbon monoxide and carbon dioxide concentrations by nondispersive infrared (NDIR) analysis and the determination of oxides of nitrogen concentrations by chemiluminescence (CL) analysis in dilute exhaust samples. The chemiluminescence method of analysis requires that the nitrogen dioxide present in the sample be converted to nitric oxide before analysis. Other types of analyzers may be used if shown to yield equivalent results and if approved in advance by the Administrator. See Figure L 175–2.

(1) Quick-connect, leak-tight fitting (C5) to attach sample bags to analytical system.

(2) Filter (F3) to remove any residual particulate matter from the collected sample.

(3) Pump (P3) to transfer samples from the sample bags to the analyzers.

(4) Selector valves (V5, V6, V7, V8, and V9) for directing samples, span gases or zeroing gases to the analyzers.

(5) Flow control valves (N3, N4, N5, N6, N7, N8, N9, N10, N11, and N12) to regulate the gas flow rates.

(6) Flowmeters (FL3, FL4, and FL5) to indicate gas flow rates.

(7) Manifold (M1) to collect the expelled gases from the analyzers.

(8) Pump (P4) to transfer expelled gases from the collection manifold to a vent external to the test room (optional).

(9) Analyzers to determine carbon monoxide, carbon dioxide, and oxides of nitrogen concentrations.

(10) An oxides of nitrogen converter to convert any NO_2 present in the samples to NO before analysis.

(11) Selector valves (V10 and V11) to allow the sample, span, calibrating or zeroing gases to bypass the converter.

(12) Water trap (T1) to partially remove water and a valve (V12) to allow the trap to be drained.

(13) Sample conditioning columns to remove remainder of water (WR1 and WR2 containing indicating calcium sulfate or indicating silica gel), and carbon dioxide (CDR1 and CDR2 containing ascarite) from the CO analysis stream.

(14) Selector valves (V13 and V14) to permit switching from exhausted absorbing columns to fresh columns.

(15) Water bubbler (W1) to allow saturation of the CO_2 span gas to check efficiency of absorbing columns.

(16) Recorders (R1, R2, and R3) or digital printers to provide permanent records of calibration, spanning and sample measurements; or in those facilities where computerized data acquisition systems are incorporated, the computer facility printout may be used.

(d) *Component description (exhaust gas continuous analytical system).* The following components will be used in the exhaust gas continuous analytical system for testing under the regulations in this part. This analytical system provides for the continuous determination of exhaust hydrocarbon concentration by heated flame ionization detector (HFID) analysis. See Figure L 175–3.

(1) Heated continuous sampling line (S3).

(2) Selector valves (V15, and V16) for directing the continuous dilute exhaust sample, dilution air bag sample, span or zeroing gases to the analyzers.

(3) Quick-connect, leak-tight fitting (C6) to attach dilution air sample bag to analytical system.

(4) Heated hydrocarbon analyzer (HFID) complete with heated pump, filter, and flow control system. The response time of this instrument shall be less than 1 second for 90 percent of full scale response.

(5) Chart recorded (R4) and analog integrator with two readouts or chart recorder (R4) and on-line digital computer for manual or electronic integration of analyzer output signal during the three operating phases of the test.

(6) Flow control valves (N13 and N14) to regulate the gas flow rates.

§ 85.175–13 Information to be recorded.

The following information shall be recorded with respect to each test:

(a) Test number.

(b) System or device tested (brief description).

(c) Date and time of day for each part of the test schedule.

(d) Instrument operator.

(e) Driver or operator.

(f) Vehicle: Make—Vehicle identification number—Model year—Transmission type—Odometer reading—Engine displacement—Engine family—Idle r.p.m.—Inertia loading—Actual road load HP. at 50 m.p.h. and drive wheel tire pressure.

(g) Dynamometer serial number and indicated road load power absorption at 50 m.p.h.

(h) All pertinent instrument information such as tuning—gain—serial numbers—detector numbers—range.

(i) Recorder charts: Identify zero, span, exhaust gas, and dilution air sample traces.

(j) Barometric pressure, ambient temperature and humidity and the temperature of the air in front (from 6 to 12 inches from the grill) of the radiator during the test.

(k) The temperature and pressure of the mixture of exhaust and dilution air entering the positive displacement pump and the pressure increase across the pump. The temperature of the mixture shall be recorded continuously or digi-

tally at a rate often enough to determine temperature variations, or it may be controlled to ±5° F. of the set point of the temperature control system. In the last case only the set point need be recorded.

(l) The number of revolutions of the positive displacement pump accumulated while the test is in progress and exhaust flow samples are being collected.

(m) The humidity of the dilution air.

(n) Operating temperature of the heated sample line and of the heated hydrocarbon detector.

§ 85.175–14 Analytical system calibration and sample handling.

(a) Calibrate the analytical assembly at least once every 30 days. Use the same flow rate as when analyzing samples.

(1) Adjust analyzers to optimize performance. Operate heated hydrocarbon analyzer and sampling line at set point (300–380° F.) ±5° F.

(2) Zero the hydrocarbon analyzer with zero grade air and the carbon monoxide, carbon dioxide, and oxides of nitrogen analyzers with zero grade nitrogen. The allowable zero gas impurity concentrations should not exceed 1 p.p.m. equivalent carbon response, 1 p.p.m. carbon monoxide, 300 p.p.m. (0.03 mole percent) carbon dioxide, and 0.1 p.p.m. nitric oxide.

(3) Set the CO and CO_2 analyzer gains to give the desired ranges. Select the desired attenuation scale of the HC analyzer, set the sample capillary flow rate by adjusting the back pressure regulator, and adjust the electronic gain control, if provided, to give the desired range. Select the desired scale of the NO_x analyzer and adjust the phototube high voltage supply or amplifier gain to give the desired range.

(4) Calibrate the HC analyzer with propane (air diluent) gases having nominal concentrations equal to 50 and 100 percent of full scale. Calibrate the CO analyzer with carbon monoxide (nitrogen diluent) gases and the CO_2 analyzer with carbon dioxide (nitrogen diluent) gases having nominal concentrations equal to 10, 25, 40, 50, 60, 70, 85, and 100 percent of full scale. Calibrate the NO_x analyzer with nitric oxide (nitrogen diluent) gases having nominal concentrations equal to 50 and 100 percent of full scale. The actual concentrations should be known tc with ±2 percent of the true values.

(5) Compare values obtained on the CO and CO_2 analyzers with previous calibration curves. Any significant change reflects some problem in the system. Locate and correct problem, and recalibrate. Use best judgment in selecting curves for data reduction.

(6) Check the NO_x to NO converter efficiency by the following procedure:

(i) Fill a new (not previously used to collect exhaust gas samples) sample bag with air (or oxygen), and NO span gas in proportions which result in a mix in the operating range of the analyzer. Provide enough oxygen for substantial conversion of NO to NO_2.

(ii) Knead bag and immediately connect the bag to the sample inlet and alternately measure the NO and NO_x concentration at 1-minute intervals by alternately passing the sample through the converter and the bypass (close valves N6 and N9 to minimize pump down rate of bag). After several minutes of operation, the recording of NO and NO_x will resemble Figure L 175–4 if the converter is efficient. Even though the amount of NO_2 increases with time, the total NO_x ($NO+NO_2$) remains constant. A decay of NO_x with time indicates the converter is not essentially 100 percent efficient and the cause should be determined before the instrument is used.

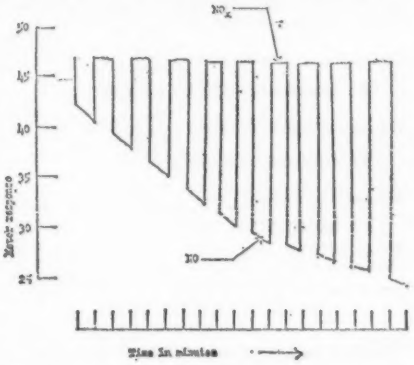

FIGURE L 175–4. CONVERTER EFFICIENCY CHECK RESPONSE

(iii) The converter efficiency should be checked at least once weekly and preferably once daily.

(7) Check the efficiency of the sample conditioning system by the following procedure:

(i) Zero and span the CO instrument on its most sensitive scale.

(ii) Recheck zero.

(iii) Bubble CO_2 span gas through water and then through the sample conditioning system into the CO instrument. If the CO instrument shows no response to the wet CO_2, the columns are in good condition.

(iv) If the CO instrument responds to wet CO_2, replace columns as necessary to bring response back to zero.

(v) The conditioning system efficiency should be checked daily.

(b) HC, CO, CO_2, and NO_x measurement; Allow HC analyzer and sample line to heat to set point (300–380°F.) ±5°F. and allow a minimum of 20 minutes warmup for the HC analyzer electronics and 2 hours for the CO, CO_2 and NO_x analyzers. (Power is normally left on infrared and chemiluminescence analyzers; but when not in use, the chopper motors of the infrared analyzers are turned off and the phototube high voltage supply of the chemiluminescence analyzer is placed in the standby position.) The following sequence of operations should be performed in conjunction with each series of measurements:

(c) For the purposes of this section, the term "zero grade air" includes artificial "air" consisting of a blend of nitrogen and oxygen with oxygen concentrations between 18 and 21 mole percent.

§ 85.175–15 Dynamometer test runs.

(a) The vehicle shall be allowed to stand with the engine turned off for a period of not less than 12 hours before the cold start exhaust emission test. The vehicle shall be stored prior to the emission tests in such a manner that precipitation (e.g. rain or dew) does not occur on the vehicle. The complete dynamometer test consists of a cold start drive of 7.5 miles and simulates a hot start drive of 7.5 miles. The vehicle is allowed to stand on the dynamometer during the 10-minute time period between the cold and hot start tests. The cold start test is divided into two periods. The first period, representing the cold start "transient" phase, terminates at the end of the deceleration which is scheduled to occur at 505 seconds of the driving schedule. The second period, representing the "stabilized" phase, consists of the remainder of the driving schedule including engine shutdown. The hot start test similarly consists of two periods. The first period, representing the hot start "transient" phase, terminates at the same point in the driving schedule as the first phase of the cold start test. The second period of the hot start test, "stabilized" phase is assumed to be identical to the second period of the cold start test. Therefore, the hot start test terminates after the first period (505 seconds) is run.

(b) The following steps shall be taken for each test:

(1) Place drive wheels of vehicle on dynamometer without starting engine.

(2) Open the vehicle engine compartment cover and start the cooling fan.

(3) With the sample solenoid valves in the "dump" position connect evacuated sample collection bags to the two dilute exhaust sample connectors and to the two dilution air sample line connectors.

(4) Start the positive displacement pump, the sample pumps, the temperature recorder, and the heated hydrocarbon analysis recorder. (The constant volume sampler heat exchanger, the hydrocarbon analyzer and continuous sample line should be preheated to their respective operating temperatures before the test begin.)

(5) Adjust the sample flow rates to the desired flow rate (minimum of 10 c.f.h.). Set the hydrocarbon integrator counters and pump revolution counters to zero.

(6) Attach the flexible exhaust tube to the vehicle tailpipe(s).

(7) Simultaneously start the revolution counter for the positive displacement pump, position the sample solenoid valves to direct the sample flows into the "transient" exhaust sample bag and the "transient" dilution air sample bag, turn on the hydrocarbon analyzer system integrator and mark recorder chart, and start cranking engine.

(8) Fifteen seconds after the engine starts, place the transmission in gear.

(9) Twenty seconds after the engine starts, begin the initial vehicle acceleration of the driving schedule.

(10) Operate the vehicle according to the dynamometer driving schedule.

(11) At the end of the deceleration which is scheduled to occur at 505 seconds, simultaneously switch the sample flows from the "transient" bags to the "stabilized" bags, switch off revolution counter No. 1 and hydrocarbon integrator No. 1, mark hydrocarbon recorder chart and start counter No. 2 and hydrocarbon integrator No. 2. As soon as possible and in no case longer than 20 minutes after the end of this portion of the test disconnect the "transient" exhaust and dilution air sample bags, transfer them to the analytical system and process the samples according to § 85.175–14.

(12) Turn the engine off 2 seconds after the end of the last deceleration (at 1,369 seconds).

(13) Five seconds after the engine stops running, simultaneously turn off revolution counter No. 2 and hydrocarbon integrator No. 2, mark hydrocarbon recorder chart and position the sample solenoid valves to the "dump" position. As soon as possible and in no case longer than 20 minutes after the end of this portion of the test disconnect the "stabilized" exhaust and dilution air sample bags, transfer them to the analytical system and process the samples according to § 85.175–14.

(14) Immediately after the end of the sample period disconnect the exhaust tube from the tailpipe(s), turn off the cooling fan and close the engine compartment cover.

(15) Turn off the positive displacement pump.

(16) Repeat the steps in subparagraphs (2) through (10) of this paragraph for the hot start test except only one evacuated sample bag is required for sampling exhaust gas and one for dilution air. The step in subparagraph (7) of this paragraph shall begin between 9 and 11 minutes after the end of the sample period for the cold start test.

(17) At the end of the deceleration which is scheduled to occur at 505 seconds, simultaneously turn off the No. 1 revolution counter and hydrocarbon integrator No. 1, mark hydrocarbon recorder chart and position the sample solenoid valve to the "dump" position. (Engine shutdown is not part of the hot start sample period.)

(18) As soon as possible and in no case longer than 20 minutes after the end of this portion of the test disconnect the hot start "transient" exhaust and dilution air sample bags, transfer them to the analytical system and process the samples according to § 85.175–14.

(19) Disconnect the exhaust tube from the vehicle tailpipe(s) and remove vehicle from dynamometer.

(20) The positive displacement pump may be turned off, if desired.

§ 85.175–16 Chart reading.

(a) Determine the HC, CO, CO_2, and NO_x concentrations of the dilution air and the CO, CO_2, and NO_x concentration of the dilute exhaust sample bags from the instrument deflection or recordings making use of appropriate calibration charts.

(b) Record integrated HC results, or manually integrate continuous chart. This chart provides a permanent record and can be graphically integrated if varification of the results of electronic integration is required.

(c) Determine the average dilute exhaust mixture temperatures from the temperature recorder trace if a recorder is used.

§ 85.175–17 Calculations (exhaust emissions).

The final reported test results shall be computed by use of the following formulae:

(a) For light duty vehicles:

$$Y_{wm}=(0.43\ Y_{ct}+0.57\ Y_{ht}+Y_s)/7.5$$

Where:
Y_{wm} = Weighted mass emissions of each pollutant, i.e. HC, CO, or NO_x, in grams per vehicle mile.
Y_{ct} = Mass emissions as calculated from the "transient" phase of the cold start test, in grams per test phase.
Y_{ht} = Mass emissions as calculated from the "transient" phase of the hot start test, in grams per test phase.
Y_s = Mass emissions as calculated from the "stablized" phase of the cold start test, in grams per test phase.

(b) The mass of each pollutant for each phase of both the cold start test and the hot start test is determined from the following:

(1) Hydrocarbon Mass:

$$HC_{mass}=V_{mix}\times Density_{HC}\times\frac{HC_{cone}}{1{,}000{,}000}$$

(2) Oxides of nitrogen Mass:

$$NO_{x_{mass}}=V_{mix}\times Density_{NO_2}\times\frac{NO_{x_{cone}}}{1{,}000{,}000}\times K_H$$

(3) Carbon monoxide Mass:

$$CO_{mass}=V_{mix}\times Density_{CO}\times\frac{CO_{cone}}{1{,}000{,}000}$$

(c) Meaning of symbols:

HC_{mass} = Hydrocarbon emissions, in grams per test phase.
$Density_{HC}$ = Density of hydrocarbons in the exhaust gas, assuming an average carbon to hydrogen ratio of 1.85 in grams per cubic foot at 68° F. and 700 mm. Hg pressure (16.33 gm./cu. ft.).
HC_{cone} = Hydrocarbon concentration of the dilute exhaust sample corrected for background, in p.p.m. carbon equivalent, i.e. equivalent propane×3.

$$HC_{cone}=HC_e-HC_d(1-1/\overline{D}F)$$

Where:
HC_e = Average hydrocarbon concentrations of the dilute exhaust sample as calculated from the integrated HC traces, in p.p.m. carbon equivalent.
HC_d = Hydrocarbon concentration of the dilution air as measured in p.p.m. carbon equivalent.
$NO_{x_{mass}}$ = Oxides of nitrogen emissions, in grams per test phase.
$Density_{NO_2}$ = Density of oxides of nitrogen in the exhaust gas, assuming they are in the form of nitrogen dioxide, in grams per cubic foot at 68° F. and 700 mm. Hg pressure (54.16 gm./cu. ft.).
$NO_{x_{cone}}$ = Oxides of nitrogen concentration of the dilute exhaust sample corrected for background, in p.p.m.

$$NO_{x_{cone}}=NO_{x_e}-NO_{x_d}(1-1/DF)$$

Where:
NO_{x_e} = Oxides of nitrogen concentration of the dilute exhaust sample as measured, in p.p.m.
NO_{x_d} = Oxides of nitrogen concentration of the dilution air as measured, in p.p.m.

CO_{mass} = Carbon monoxide emissions, in grams per test phase.
$Density_{CO}$ = Density of carbon monoxide in grams per cubic foot at 68° F. and 700 mm. Hg pressure (32.97 gm./cu. ft.).
CO_{cone} = Carbon monoxide concentration of the dilute exhaust sample corrected for background, water vapor and CO_2 extraction, in p.p.m.

$$CO_{cone}=CO_e-CO_d\ (1-1/DF)$$

Where:
CO_e = Carbon monoxide concentration of the dilute exhaust sample volume corrected for water vapor and carbon dioxide extraction, in p.p.m. The calculation assumes the carbon to hydrogen ratio of the fuel is 1:1.85.

$$CO_e=(1-0.01925\ CO_{2e}-0.000323\ R)\ CO_{em}$$

Where:
CO_{em} = Carbon monoxide concentration of the dilute exhaust sample as measured in p.p.m.
CO_{2e} = Carbon dioxide concentration of the dilute exhaust sample, in mole percent.
R = Relative humidity of the dilution air, in percent.
CO_d = Carbon monoxide concentration of the dilution air corrected for water vapor extraction, in p.p.m.

$$CO_d=(1-0.000323\ R)\ CO_{dm}$$

Where:
CO_{dm} = Carbon monoxide concentration of the dilution air sample as measured, in p.p.m.

$$DF=\frac{13.4}{CO_{2e}+(HC_e+CO_e)\times 10^{-4}}$$

V_{mix} = Total dilute exhaust volume in cubic feet per test phase corrected to standard conditions (528° R and 760 mm. Hg).

$$V_{mix}=V_0\times N\frac{(P_B-P_1)\ (528°\ R)}{(700\text{ mm. Hg})(T_p)}.$$

Where:
V_0 = Volume of gas pumped by the positive displacement pump, in cubic feet per revolution. This volume is dependent on the pressure differential across the positive displacement pump.
N = Number of revolutions of the positive displacement pump during the test phase while samples are being collected.
P_B = Barometric pressure in mm. Hg.
P_1 = Pressure depression below atmospheric measured at the inlet to the positive displacement pump.
T_p = Average temperature of dilute exhaust entering positive displacement pump during test while samples are being collected, in degrees Rankine.
K_H = Humidity correction factor.

$$K_H=\frac{1}{1-0.0047\ (H-75)}$$

NOTE: The constant 0.0047 will be updated to reflect any data which becomes available on Light-Duty diesel engine tests.

Where:
H = Abolute humidity in grains of water per pound of dry air.

$$H=\frac{(43.478)\ R_a\times P_d}{P_B-(P_d\times R_a/100)}$$

R_a = Relative humidity of the ambient air, in percent.
P_d = Saturated vapor pressure, in mm. Hg at the ambient dry bulb temperature.

(d) Example calculation of mass emissions values:

(1) For the "transient" phase of the cold start test assume V_0=0.29344 cu. ft. per revolution; N=10,485; R=48.0 percent; R_a=48.2 percent; P_B=762 mm. Hg; P_d=22.225 mm. Hg; P_i=70 mm. Hg; T_p=570° R; HC_e=105.8 p.p.m. carbon equivalent; NO_{xe}=11.2 p.p.m.; CO_{em}=306.6 p.p.m.; CO_{2e}=1.43 percent; HC_d=12.1 p.p.m.; NO_{xd}=0.8 p.p.m.; CO_{dm}=15.3 p.p.m. Then:

$$V_{mix}=\frac{(0.29344)\ (10{,}485)\ (762-70)\ (528)}{(760)\ (570)}=2695.0 \text{ cu. ft. per test phase.}$$

$$H=\frac{(43.478)\ (48.2)\ (22.225)}{762-(22.225\times 48.2/100)}$$

$$K_H=\frac{1}{1-0.0047(62-75)}=0.9424.$$

$$CO_e=(1-0.01925(1.43)-0.000323(48))306.0=293.4 \text{ p.p.m.}$$
$$CO_d=(1-0.000323(48))15.3=15.1 \text{ p.p.m.}$$

$$DF=\frac{13.4}{1.43+(105.8+293.4)\times 10^{-4}}=9.116.$$

$$HC_{conc}=105.8-12.1(1-1/9.116)=95.03.$$
$$HC_{mass}=(2695)\ (16.33)\ (95.03/1{,}000{,}000)=4.027 \text{ grams per test phase.}$$
$$NO_{x_{conc}}=11.2-0.8(1-1/9.116)=10.49.$$
$$NO_{x_{mass}}=(2695)\ (54.16)\ (10.49/1{,}000{,}000)\ (0.9424)=1.389 \text{ grams per test phase.}$$
$$CO_{conc}=293.4-15.1(1-1/9.116)=280.$$
$$CO_{mass}=(2695)\ (32.97)\ (280/1{,}000{,}000)=23.96 \text{ grams per test phase.}$$

(2) For the "stabilized" portion of the cold start test assume that similar calculations resulted in HC_{mass}=0.62 grams per test phase; NO_{xmass}=1.27 grams per test phase; and CO_{mass}=5.98 grams per test phase.

(3) For the "transient" portion of the hot start test assume that similar calculations resulted in HC_{mass}=0.51 grams per test phase; NO_{xmass}=1.38 grams per test phase; and CO_{mass}=5.01 grams per test phase.

(4) For a 1975 light-duty vehicle:

$$HC_{wm}=((0.43)(4.027)+(0.57)(0.51)+0.62)/7.5=0.352 \text{ grams per vehicle mile.}$$
$$NO_{xwm}=((0.43)(1.389)+(0.57)(1.38)+1.27)/7.5=0.354 \text{ grams per vehicle mile.}$$
$$CO_{wm}=((0.43)(23.96)+(0.57)(5.01)+5.98)/7.5=2.55 \text{ grams per vehicle mile.}$$

§ 85.175–18 Test vehicles.

(a) (1) The vehicles covered by the application for certification will be divided into groupings of vehicles whose engines are expected to have similar emission characteristics. Each group of engines with similar emission characteristics shall be defined as a separate engine family.

(2) To be classed in the same engine family, engines must be identical in all the following respects:

(i) The cylinder bore center to center dimensions.

(ii) The dimension from the centerline of the crankshaft to the centerline of the camshaft.

(iii) The dimension from the centerline of the crankshaft to the top of the cylinder block head face.

(iv) The cylinder block configuration (air-cooled or water-cooled; L–6, 90° V–8, etc.).

(v) The location of intake and exhaust valves and the valve sizes (within a ⅛-inch range on the valve head diameter).

(vi) The method of air aspiration.

(vii) The combustion cycle.

(3) Engines identical in all the respects listed in subparagraph (2) of this paragraph may be further divided into different engine families if the Administrator determines that they may be expected to have different emission characteristics. This determination will be based upon a consideration of the following features of each engine:

(i) The bore and stroke.

(ii) The surface to volume ratio of the nominally dimensioned cylinder at the top dead center position.

(iii) The intake manifold induction port size and configuration.

(iv) The exhaust manifold port size and configuration.

(v) The intake and exhaust valve sizes.

(vi) The fuel system.

(vii) The camshaft timing and ignition timing characteristics.

(4) Where engines are of a type which cannot be divided into engine families based upon the criteria listed in subparagraphs (2) and (3) of this paragraph, the Administrator will establish families for those engines based upon the features most related to their emission characteristics.

(b) Emission data vehicles:

(1) Vehicles will be chosen to be operated and tested for emission data based upon the engine family groupings. Within each engine family, the requirements of this paragraph must be met.

(2) Vehicles of each engine family will be divided into engine displacement-exhaust emission control system-combinations. A projected sales volume will be established for each combination for the model year for which certification is sought. One vehicle of each combination will be selected in order of decreasing projected sales volume until 70 percent of the projected sales of a manufacturer's total production of vehicles of that engine family is represented, or until a maximum of four vehicles is selected. If any single combination represents over 70 percent, then two vehicles of that combination will be selected. The vehicle selected for each combination will be specified by the Administrator as to transmission type, fuel system, and inertia weight class.

(3) The Administrator may select a maximum of four additional vehicles within each engine family based upon features indicating that they may have the highest emission levels of the vehicles in that engine family. In selecting these vehicles, the Administrator will consider such features as the emission control system combination, induction system characteristics, ignition system characteristics, fuel system, rated horsepower, rated torque, compression ratio, inertia weight class, transmission options and axle ratios.

(4) If the vehicles selected in accordance with subparagraphs (2) and (3) of this paragraph do not represent each engine-system combination, then one vehicle of each engine-system combination not represented will be selected by the Administrator. The vehicle selected shall be of the engine displacement with the largest projected sales volume of vehicles with the control system combination in the engine family and will be designated by the Administrator as to transmission type, fuel system, and inertia weight class.

(c) Durability data vehicles:

(1) A durability data vehicle will be selected by the Administrator to represent each engine-system combination. The vehicle selected shall be of the engine displacement with the largest projected sales volume of vehicles with that control system combination in that engine family and will be designated by the Administrator as to transmission type, fuel system and inertia weight class.

(2) If an exhaust emission control system is used in only one engine family, an additional vehicle using that system in that family will be selected so that the durability data fleet shall contain at least two vehicles with each system. The additional vehicle will be selected in the same manner as vehicles selected under subparagraph (1) of this paragraph.

(3) A manufacturer may elect to operate and test additional vehicles to represent any engine-system combination. The additional vehicles must be of the same engine displacement, transmission type, fuel system and inertia weight class as the vehicle selected for that engine-system combination in accordance with the provisions of subparagraph (1) of this paragraph. Notice of an intent to operate and test additional vehicles shall be given to the Administrator not later than 30 days following notification of the test fleet selection.

(d) For purposes of testing under § 85.175–20(g) the Administrator may require additional emission data vehicles and durability data vehicles identical in all material respects to vehicles selected in accordance with paragraphs (b) and (c) of this section: *Provided*, That the number of vehicles selected shall not increase the size of either the emission data fleet or the durability data fleet by more than 20 percent or one vehicle, whichever is greater.

(e) Any manufacturer whose projected sales of new motor vehicles subject to this subpart for the model year for which certification is sought is less than 2,000 vehicles may request a reduction in the number of test vehicles determined in accordance with the foregoing provisions of this section. The Administrator may agree to such lesser number as he determines would meet the objectives of this procedure.

(f) In lieu of testing an emission data or durability data vehicle selected under paragraph (b) or (c) of this section and

submitting data therefore, a manufacturer may, with the prior written approval of the Administrator, submit data on a similar vehicle for which certification has previously been obtained.

(g) (1) Where it is expected that more than 33 percent of an engine family will be equipped with an optional item, the full estimated weight of that item shall be included in the curb weight computation for the entire engine family. Where it is expected that 33 percent or less of the vehicles in an engine family will be equipped with an item of optional equipment, no weight for that item will be added in computing curb weight. Optional equipment weighing less than 3 pounds per item need not be considered.

(2) Where it is expected that more than 33 percent of an engine family will be equipped with an item of optional equipment that can reasonably be expected to influence exhaust emissions, then such items of optional equipment shall actually be installed on all emission data and durability data vehicles for such engine family.

§ 85.175–19 Maintenance.

(a) (1) Maintenance on the engines and fuel systems of durability vehicles may be performed only under the following provisions:

(i) One major engine tuneup to manufacturer's specifications may be performed at 24,000 miles (±250 miles) of scheduled driving with the following exception: On a vehicle with an engine displacement of 150 cubic inches or less (or a rating of at least 1.20 maximum rated horsepower per cubic inch of displacement) major engine tuneups may be performed at 12,000, 24,000, and 36,000 miles (±250 miles) of scheduled driving. A major engine tuneup shall be restricted to the following:

(*a*) Adjust low idle speed.
(*b*) Adjust valve lash if required.
(*c*) Adjust injector timing.
(*d*) Adjust governor.
(*e*) Clean and service injector tips.
(*f*) Adjust drive belt tension on engine accessories.
(*g*) Check engine bolt torque and tighten as required.

(ii) Injectors may be changed if a persistent misfire is detected.

(iii) Normal vehicle lubrication services (engine and transmission oil change and oil filter, fuel filter, and air filter servicing) will be allowed at manufacturer's recommended intervals.

(iv) The crankcase emission control system may be serviced at 12,000-mile intervals (±250 miles) of scheduled driving.

(v) Readjustment of the engine idle settings may be performed only if there is a problem of stalling at stops.

(vi) Leaks in the fuel system, engine lubrication system and cooling system may be repaired.

(vii) Engine idle speed may be adjusted at the 4,000-mile test point.

(viii) Any other engine or fuel system maintenance or repairs may be allowed with the advance approval of the Administrator.

(2) Repairs to vehicle components of the durability data vehicle, other than the engine or fuel system shall be performed only as a result of part failure or vehicle system malfunction.

(3) Allowable maintenance on emission data vehicles shall be limited to the adjustment of engine idle speed at the 4,000-mile test point, except that other maintenance or repairs may be allowed with the advance approval of the Administrator.

(4) Where the Administrator agrees under § 85.175–20 to a mileage accumulation of less than 50,000 miles for durability testing, he may modify the requirement of this paragraph.

(b) Complete emission tests (see §§ 85.175–3 to 85.175–17) shall be run before and after any vehicle maintenance which may reasonably be expected to affect emissions. These test data shall be supplied to the Administrator immediately after the tests, along with a complete record of all pertinent maintenance, including an engineering report of any malfunction diagnosis and the corrective action taken. In addition, all test data and maintenance reports shall be compiled and provided to the Administrator in accordance with § 85.53.

(c) If the Administrator determines that maintenance or repairs performed have resulted in a substantial change to the engine-system combination, the vehicle shall not be used as a durability data vehicle.

§ 85.175–20 Mileage accumulation and emission measurements.

The procedure for mileage accumulation will be the Durability Driving Schedule as specified in Appendix D to this part. A modified procedure may also be used if approved in advance by the Administrator.

(a) Emission data vehicles: Each emission data vehicle shall be driven 4,000 miles with all emission control systems installed and operating. Emission tests shall be conducted at zero miles and 4,000 miles.

(b) Durability data vehicles: Each durability data vehicle shall be driven with all emission control systems installed and operating, for 50,000 miles or such lesser distance as the Administrator may agree to as meeting the objectives of this procedure. Emission measurements from a cold start shall be made at zero miles and at each 4,000-mile interval.

(c) All tests required by this subpart to be conducted after 4,000 miles of driving or at any multiple of 4,000 miles may be conducted at any accumulated mileage within 250 miles of 4,000 miles or the appropriate multiple of 4,000 miles, respectively.

(d) The results of each emission test shall be supplied to the Administrator immediately after the test. Where a manufacturer conducts multiple tests at any test point or any tests between test points, data on these tests (including voided tests) shall be provided to the Administrator in accordance with § 85.53.

(e) Whenever the manufacturer proposes to operate and test a vehicle which may be used for emission or durability data, he shall provide the zero mile test data to the Administrator and make the vehicle available for such testing under § 85.54 as the Administrator may require before beginning to accumulate mileage on the vehicle. Failure to comply with this requirement will invalidate all test data submitted for this vehicle.

(f) Once a manufacturer begins to operate an emission data or durability data vehicle, as indicated by compliance with paragraph (e) of this section, he shall continue to run the vehicle to 4,000 miles or 50,000 miles, respectively, and the data from the vehicle will be used in the calculations under § 85.175–21. Discontinuation of a vehicle shall be allowed only with the written consent of the Administrator.

(g) (1) The Administrator may elect to operate and test any test vehicle during all or any part of the mileage accumulation and testing procedure. In such cases, the manufacturer shall provide the vehicle(s) to the Administrator with all information necessary to conduct this testing.

(2) The test procedures (§§ 85.175–3 to 85.175–17) will be followed by the Administrator. Maintenance may be performed by the manufacturer under such conditions as the Administrator may prescribe.

(3) The data developed by the Administrator for the engine system combination shall be combined with any applicable data supplied by the manufacturer on other vehicles of that combination to determine the applicable deterioration factors for the combination. In the case of a significant discrepancy between data developed by the Administrator and that submitted by the manufacturer the Administrator's data shall be used in the determination of deterioration factors.

§ 85.175–21 Compliance with emission standards.

(a) The exhaust emission standards in the regulations in this part apply to the emissions of vehicles for their useful life.

(b) Since it is expected that emission control efficiency will change with mileage accumulation on the vehicle, the emission level of a vehicle which has accumulated 50,000 miles will be used as the basis for determining compliance with the standards.

(c) The procedure for determining compliance of a new light-duty motor vehicle with exhaust emission standards is as follows:

(1) Separate emission deterioration factors shall be determined from the emissions results of the durability data vehicles for each engine-system combination. A separate factor shall be established for the combination for exhaust HC, exhaust CO, and exhaust NO_x.

(i) The applicable results to be used in determining the deterioration factors for each combination shall be:

(*a*) All emission data from the tests required under § 85.175–20(b), except the zero mile tests. This shall include the

official test results as determined in § 85.54 for all tests conducted on all durability vehicles of the combination selected under § 85.175–18(c) (including all vehicles elected to be operated by the manufacturer under § 85.175–18(c)(3)). Where the Administrator has agreed to a mileage less than 50,000 miles in accordance with § 85.175–20(b), the data for mileages greater than that actually run will be determined by extrapolating the test data generated at lesser mileages.

(*b*) All emission data from the tests conducted before and after the maintenance provided in § 85.175–19(a)(1)(i).

(ii) All applicable results shall be plotted as a function of the mileage on the system, rounded to the nearest mile, and the best fit straight lines, fitted by the method of least squares, shall be drawn through these data points. The interpolated 4,000 and 50,000 mile points on this line must be within the standards provided in § 85.175–2 or the data will not be acceptable for use in calculation of a deterioration factor.

(iii) An exhaust emission deterioration factor shall be calculated for each combination as follows:

$$\text{factor} = \frac{\text{exhaust emissions interpolated to 50,000 miles}}{\text{exhaust emissions interpolated to 4,000 miles.}}$$

(2) The exhaust emission test results for each emission data vehicle shall be multiplied by the appropriate deterioration factor: *Provided*, That if a deterioration factor as compared in subparagraph (1)(iii) of this paragraph is less than one, that deterioration factor shall be one for the purposes of this subparagraph.

(3) The emissions to compare with the standard shall be the adjusted emissions of subparagraph (2) of this paragraph for each emission data vehicle.

(4) Every test vehicle of an engine family must comply with all applicable standards, as determined in subparagraph (3) of this paragraph, before any vehicle of that family may be certified.

§ 85.176–1 Applicability (1976 model year).

With the exception of the nitrogen oxides exhaust emission standard, the standards and test procedures set forth in § 85.175–2(b) through § 85.175–21 remain applicable for the 1976 model year.

§ 85.176–2 Standards for exhaust emissions.

(a) Exhaust emissions from 1976 model year vehicles shall not exceed:

(1) Hydrocarbons—0.41 grams per vehicle mile.

(2) Carbon monoxide—3.4 grams per vehicle mile.

(3) Oxides of nitrogen—0.40 grams per vehicle mile.

[FR Doc.72–16530 Filed 10–3–72;8:45 am]

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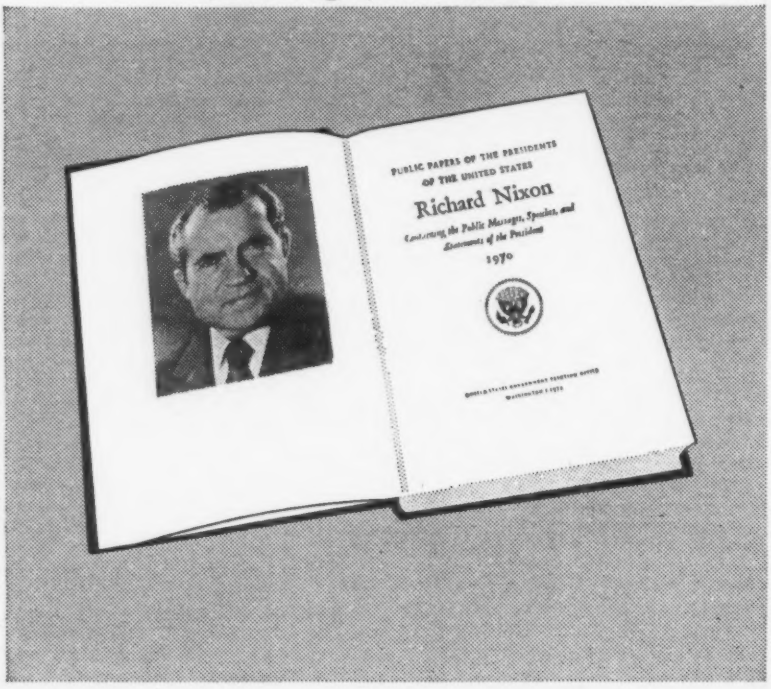

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